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Japan's Value Added Market: Wood Product Attributes and Competition

Attribute Analysis: Engineered Structural Products

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All errors or omissions remain the responsibility of the authors.

Executive Summary

General Results

- Approximately 170 small builders provided information for this report. They primarily construct single family detached houses and operate in one of the three large metropolitan areas of Japan (Tokyo, Nagoya and Osaka).
- Approximately 130 pre-cutters provided information for this report.
- Over the next 3 years small house builders expect:
  - Traditional post and beam construction to decline dramatically (49%), 2 by 4 to increase substantially (28%), hybrid houses to increase dramatically (154%) and steel, concrete to increase slightly (<6%) and prefabricated houses to decline slightly.
- Over the next 3 years pre-cutters expect:
  - Traditional post and beam construction to decline slightly (2%), 2 by 4 to increase slightly (1%), hybrid houses to increase (3%) and steel, concrete and prefabricated houses to decrease slightly (<2%).
- Builders and pre-cutters prefer to build post and beam houses in the traditional manner even if paneling is required.
- Both builders and pre-cutters are very aware of the growing concern with formaldehyde emissions. Slightly less than half of each group is willing to pay a small premium for a panel with emission less than current standards allowed.
- For structural members, builders prefer solid wood followed by engineered wood products, steel and lastly concrete.
- Both groups rank strength, durability and price stability and the most important attributes of engineered structural products (ESP).

	Builders' Rank	Pre-cutters' Rank
strength	1	1
durability	2	3
price stability	3	2
connections	4	7
security of supply	5	4
species	6	5
supply reliability	7	N/A
treatability	8	8
source of material	9	10
country of manufacture	10	9

- Builders expect ESP to capture 85% of the market for hari (upper level beams) while pre-cutters expect 95%.
  - Builders and pre-cutters expect ESP to capture over 50% of the market for kanbashira (posts), keta (beams), and hari (upper level beams).
  - Greatest growth in % for hari (upper level beams), obiki (joist beam) and neda (joist) for both groups.
  - Both consumers and pre-cutters expect increased use for ESP in all structural applications in traditional house.
  - Builders expect to use a greater proportion of solid wood for taruki, neda (joist), obiki (joist beams), foundations, and mabashira (studs) despite growth is use for ESP..
- Strength is the highest ranked attribute for both groups.
  - Preference by both builders and pre-cutters is for slight or moderate strength increases relative to current codes.
- Few builders or pre-cutters are willing to pay premiums for increased strength.
- As strength requirements increase builders consider Douglas fir more frequently and Hemlock less frequently.
- While price stability is a highly ranked attribute, the trade off analysis indicates that price is more important than price stability.
- Respondents indicate a preference for prices that are stable for 3 months or more.
- Builders consider connections a more important attribute than pre-cutters.
  - Builders and pre-cutters prefer traditional connections that also use steel followed by steel and traditional with almost equal preference.
- Country of origin and the source of purchase of materials are relatively unimportant to both builders and pre-cutters.
- Any preference pre-cutters have for Canadian Hemlock dropped precipitously once prices increase.
- Douglas fir, followed by Japanese wood, are the species of choice for pre-cutters while builders have no specific preference for any species.
- Both builders and pre-cutters are very price sensitive with no indication of willingness to pay premiums for any attribute.
  - Species can substitute for each other.
  - Connections are the least price sensitive.

Opportunities for Engineered Structural Products

- Preference for solid wood indicates an opportunity to provide "engineered solid structural members" for traditional housing in Japan.
  - These could be dry, MSR members for use in taruki, neda (joist), obiki (joist beams), foundations, and mabashira (studs).
  - These products should be available with 3 weeks or less lead time.
  - They should be priced between laminated product prices and solid green product prices.
  - They should ignore species make-up and focus on strength and stability characteristics.
- Solid wood members should incorporate information and promotion on low emissions for "healthy houses" compared to ESP and non-wood alternatives.
- Combining information from ESP with that from Building Systems (see Report F) suggests incorporating ESP in newly designed row houses or hybrid houses.
- With price such a key issue the relative cost of production in BC needs to be compared with current and future suppliers of ESP to this market (e.g. Austria, US, Sweden, New Zealand and Japan).
  - To succeed, BC producers must be the low cost producer in this higher cost market niche .

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1 Introduction

This report presents the results of personal interviews and surveys conducted in Japan from March 1998 to June 1998. Each of the six product groups are presented in separate reports starting with Wood Furniture followed by Outdoor Furnishings, Interior Finish, Wood Structural Members, Engineered Structural Products and Building Systems. This section summarizes the results for Engineered Structural Products. Table 1 shows which groups were surveyed for each product group.

Table 1: Product Groups and Interview Groups

Product Group	Types of People Interviewed
Building systems	Small builders & consumers
Engineered structural products	Small builders & pre-cutters
Wood structural members	Small builders & pre-cutters
Interior finish	Small builders & designers & consumers
Wood furniture	Consumers & designers
Outdoor furnishings & decking	Consumers

All reports follow the same format. First there is a summary of the general questions for the product category for each group interviewed. The survey questions are summarized with minimal commentary. Many of the questions will be clear from the text but to facilitate ease of use the questionnaire is shown in Appendix 1. Following this summary are the results of the conjoint (or trade-off) analysis for each group interviewed[1]. This includes both simple trade-offs and trade-offs between two variables. The third set of results is a brief summary of the market share analysis. This section briefly examines the implications of changing attributes on market share of different products. The last section summarizes the most meaningful results and identifies opportunities for BC producers.

Information regarding Engineered Structural Products was collected from two market segments: small house builders and pre-cutters. Information was collected in Japan from April-June 1998 through direct interviews of 170 builders and 135 pre-cutters located in one of the three major metropolitan areas (Tokyo, Osaka and Nagoya).

[1] For a full discussion of the methods used in this study please see the report titled "Introduction and Methodology for Wood Attribute Analysis.

2 Response to Questionnaire

2.1 Builders and House Construction[2]

The builders interviewed were the small house builders that are responsible for most of the wood house construction in Japan. Respondents were asked to identify the type and number of houses built in 1997. Table 2 shows the average number of houses per respondent by house type.

Table 2: Average Number of Houses Built by Construction Method

Type of House Construction	Avg. no. of houses/respondent
Post & Beam (traditional)	13.4
2 by 4	14.0
hybrid (mix of P&B and 2 by 4)	10.3
Prefabricated	23.2
Steel/Concrete	42.0

Results show that of the 3,720 houses built by respondents:

- ⇒ 56.4% are traditional post and beam,
- ⇒ 22.6% are 2 by 4,
- ⇒ 13.2% are hybrid houses (a mix of post and beam and 2 by 4 including mixes of concrete basements and wood stories),
- ⇒ 4.1% are steel or concrete and
- ⇒ 3.7% are prefabricated houses.

Builders were also asked how many and what type of house they expected to build three years from now in order to establish perceived trends. The cumulative results are shown below:

- ⇒ traditional post and beam is expected to decline to 49.4%,
- ⇒ 2 by 4 is expected to increase to 27.8%,
- ⇒ hybrid houses are also expected to increase to 15.3%,
- ⇒ steel and concrete are expected to increase to 5.5%,
- ⇒ prefabricated are expected to decrease to 1.9%.

[2] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

In order to find out how builders would consider the use of panels in the most common types of wood construction they were asked to rate their preference for a variety of building systems. The addition of exterior panels, particularly to traditional post and beam construction is under consideration for increased strength and stability in earthquake zones. Figure 1 shows that most small builders prefer to build as they always have without the use of panels.

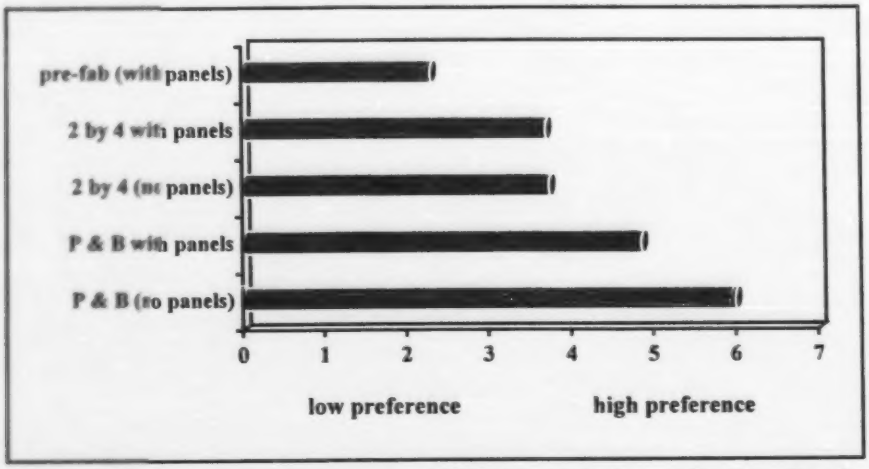

Figure 1: Preference for Construction Methods and the Use of Exterior Panels

There is a fairly even distribution of the size of house building firms represented with 19% building between 1-5 houses per year, 25% building between 6 and 10, 24% building 11-20 and 32% building over 20 houses annually.

2.2 Pre-cutters and House Construction[3]

The pre-cutters interviewed tended to build more than 20 houses per year. The exact breakdown is shown in Table 3.

Table 3: Size of Pre-cutters Interviewed

Number of Houses	% of 130 respondents
1-5 per year	3.8%
6-10 per year	6.9%
11-20 per year	20.0%
over 21 per year	69.2%

[3] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

Respondents were asked to identify the type and number of houses built in 1997. The following table shows the average number of houses per respondent by house type. Results show that respondents built 77,799 houses in 1997.

The houses built in 1997 consisted of the following types:

- ⇒ 76.7% were traditional post and beam,
- ⇒ 15.9% were 2 by 4,
- ⇒ 1.7% were hybrid houses (a mix of post and beam and 2 by 4 including mixes of concrete basements and wood stories),
- ⇒ 2.9% were steel or concrete and
- ⇒ 2.8% were prefabricated houses.

Pre-cutters were also asked how many and what type of house they expected to build three years from now in order to establish perceived trends. They expect to triple the number of houses they build. Results by house type are shown below:

- ⇒ traditional post and beam is expected to decline by 1.7%,
- ⇒ 2 by 4 is expected to increase by 0.7%,
- ⇒ hybrid houses are also expected to increase by 3.0%,
- ⇒ steel and concrete are expected to decline by 1.8%,
- ⇒ prefabricated are expected to decline by 0.1%.

In order to find out how pre-cutters consider the use of panels in the most common types of wood construction, they were asked to rate their preference for a variety of building systems. The addition of exterior panels, particularly to traditional post and beam construction is under consideration for increased strength and stability in earthquake zones. Figure 2 below shows that pre-cutters are more open to the use of panels than small builders.

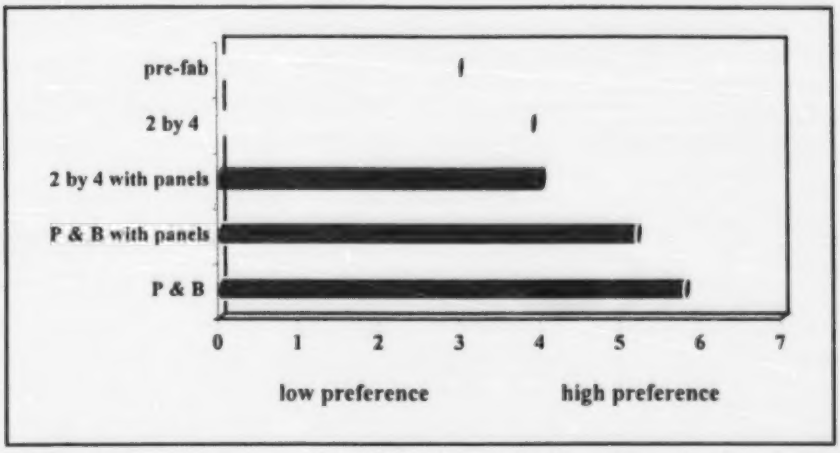

Figure 2: Preference for Construction Methods and the Use of Exterior Panels (Pre-cutters)

2.3 Health Issues[4]

To gauge concerns over health issues several question were asked regarding formaldehyde emissions as well as willingness to pay for lower emissions.

2.3.1 Builders and Health Issues

Over 95% of all respondents indicate that they are aware of the growing concern over formaldehyde emission in Japan and are interested in a panel with 1/50th of the current emission standard. Slightly less than half (44%) are willing to pay a small premium for a panel with much lower formaldehyde emissions than current standards.

2.3.2 Pre-cutters and Health Issues

Almost 97% of pre-cutters indicate that they were aware of the growing concern over formaldehyde emission in Japan and 85% are interested in a panel with 1/50th of the current emission standard. Slightly less than half (46%) were willing to pay a small premium for a panel with much lower formaldehyde emissions than current standards.

[4] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

2.4 Answers to Questionnaire on Engineered Structural Products

2.4.1 Builders and Engineered Structural Products

Eighty-five builders answered questions concerning engineered structural products. They ranked the five most important attributes in an engineered structural product. Table 4 summarizes the results and calculates the score by assigning 5 points for a first place ranking, 4 points for a second place ranking, 3 points for a third place ranking and so on with 0 points if the attribute was not ranked.

It is very interesting to note that the countries of origin of material and source of material are of little importance to builders. Their primary concerns are with performance characteristics (strength, durability and connections). Service characteristics are also very important and include price stability and security of supply.

Table 4: Builders' Most Important Attributes for Engineered Structural Products

Attribute	Score
strength	304
durability	261
price stability	228
connections	139
security of supply	108
species	88
supply reliability	71
treatability	45
source of material	9
country of manufacture	7

Builders were also asked to indicate the specific location in a traditional post and beam house where they used, consider using, and expect to use engineered structural products. Table 5 shows the responses with the "do not expect to use" column calculated by subtracting the "have used" and "expect to use" from the total number of respondents.

Table 5: Builders Use of Engineered Structural Products (n=79)

	have used	have considered	expect to use	do not expect to use
foundation itself	12.7%	19.0%	22.8%	64.6%
hari (upper level beams)	62.0%	24.1%	24.1%	13.9%
keta (beam)	46.8%	22.8%	15.2%	38.0%
obiki (joist beam)	15.2%	32.9%	19.0%	65.8%
neda (joist)	13.9%	29.1%	19.0%	67.1%
kanbashira (posts)	54.4%	20.3%	12.7%	32.9%
toshibashira	36.7%	25.3%	10.1%	53.2%
taruki	10.1%	25.3%	16.5%	73.4%
mabashira (stud)	30.4%	25.3%	16.5%	53.2%

- The greatest use is for hari (upper level beams).
  - ⇒ ESP are expect to capture >85% market share despite preference of builders for solid wood over engineered wood products for structural members (see Report E: Wood Structural Members).
  - ⇒ The ranking of attributes may provide some explanation since price stability has been a key difference between engineered structural products and solid wood products (though no longer true).
- Builders expect engineered structural products (ESP) to capture over 50% market share for posts, beams and upper level beams.
- The greatest growth for use of engineered structural products is for hari (upper level beams), foundations, obiki (joist beams) and neda (posts)
- Builders expect increased use of engineered structural products in all types of structural members in traditional post and beam houses.
- Builders expect to use a greater proportion of solid wood for taruki, neda (joist), obiki (joist beams), foundations, and mabashira (studs) despite growth in overall use for ESP.

2.4.2 Pre-cutters and Engineered Structural Products

One hundred and thirty pre-cutters answered questions concerning engineered structural products. They were asked to rank the five most important attributes in an engineered structural product. Table 6 summarizes the results and calculates the score by assigning 5 points for a first place ranking, 4 points for a second place ranking, 3 points for a third place ranking and so on with 0 points if the attribute was not ranked.

It is very interesting to note that the country of origin for material and the Japanese source of distribution for material are of little importance to pre-cutters as well as builders. Their primary concerns are with performance characteristics (strength and durability) as well as stability in both prices and supply.

Table 6: Pre-cutters' Most Important Attributes for Engineered Structural Products

Attribute	Score	Builders' Rank
strength	489	1
price stability	456	3
durability	327	2
security of supply	297	5
species	168	6
distributor	114	N/A
connections	48	4
treatability	33	8
source of material	12	9
country of manufacture	11	10

- The three most important attributes for both pre-cutters and builders are strength, durability and price stability.
- Connections are much more important to pre-cutters than builders.
- Species is equally important to both builders and pre-cutters (ranked 6th).
- The source of material (i.e. producer) and country of manufacture were unimportant indicating that there is little allegiance to any single manufacturer or country of origin.

Respondents were also asked to indicate the specific location in a traditional post and beam house where they used, considering using and expected to use engineered structural products. Table 7 shows the responses with the "do not expect to use" column calculated by subtracting the "have used" and "expect to use" from the total number of respondents.

Table 7: Pre-cutters' Use of Engineered Structural Products (n=111)

	have used	have considered	expect to use	do not expect to use
foundation itself	29.7%	25.2%	25.2%	45.0%
hari (upper level beams)	91.9%	4.5%	4.5%	3.6%
keta (beam)	84.7%	6.3%	5.4%	9.9%
obiki (joist beam)	22.5%	26.1%	25.2%	52.3%
neda (joist)	21.6%	29.7%	23.4%	55.0%
kanbashira (posts)	93.7%	3.6%	1.8%	4.5%
toshibashira	92.8%	5.4%	0.9%	6.3%
taruki	15.3%	32.4%	22.5%	62.2%
mabashira (stud)	76.6%	9.9%	4.5%	18.9%

- The greatest use of ESP is for upper level beams (hari), upper level beams (keta), posts (kanbashira) and toshibashira.
  - ⇒ Over 90% of pre-cutters have used ESP in these applications.
  - ⇒ Pre-cutters expect ESP to capture >95% market share.
  - ⇒ Some of the key differences between solid wood products and ESP are price stability and security of supply.
- Pre-cutters expect engineered structural products (ESP) to capture over 50% market share for posts, beams and upper level beams.
- The greatest growth in the use of engineered structural products for pre-cutters is for obiki (joist beams, foundations, neda (posts) and taruki.
- Pre-cutters expect an increase in use for engineered structural products for all types of structural members in traditional post and beam houses
- Pre-cutters expect to use a greater proportion of solid wood for taruki, neda (joist) and obiki (joist beams) despite growth in the use of ESP.
- For obvious reasons pre-cutters expect a higher use of engineered structural products than builders but both groups expect continued growth in the substitution of solid members with engineered members.

3 Trade-Off Analysis: Engineered Structural Products

For each product group designers and some consumers were asked to make choices between different types of products. Using trade-off analysis (or conjoint analysis) respondents are forced to trade off different attributes of a product. For example they would not be able to get all the best possible attributes at the lowest possible price but must make choices concerning how they will spend their limited resources. The methodology is complex and will not be discussed in this paper however an example of the type of choice they had to make is shown in Table 8. Each respondent had to make 20 such choices for engineered structural products.

Table 8: Example of Choice Made for Engineered Structural Products

Please select one of the 4 choices shown below.			
1	2	3	4
♦ price same as solid wood alternative	♦ price 20% more than solid wood	♦ price 40% more than solid wood	None of the choices are suitable
♦ price changes with solid wood	♦ price stable for 3 months	♦ price stable for 1 year	
♦ meets minimum strength codes	♦ slightly stronger than code	♦ moderately stronger than code	
♦ traditional connections	♦ new steel connectors	♦ mix of traditional and steel	
♦ from local wholesaler	♦ from national supplier	♦ from local retailer(s)	
♦ other offshore species	♦ Canadian Hemlock	♦ Japanese wood	

There are several types of results that will be reported. First will be the relative proportion of respondents that chose a certain level for a specific attribute. These simple trade-offs are discussed briefly. Second will be how respondents made trade-offs among different attributes. This helps determine if respondents are willing to pay a premium for certain attributes. The third type of analysis reported is in the market share section and involves "what if" analysis. For example how much market share would a certain product achieve assuming our respondents are representative of all consumers or designers. Product attributes and their levels were selected with input from industry and government personnel both in BC and Japan. The last section summarizes key results and apparent opportunities.

The results of these attribute analyses will feed into the international trade analysis to assess BC's relative competitiveness in a global market for specific product groups. They will also provide direction for determining which species in BC can be best used to meet Japanese customer requirements and lead to a revision of both key results and opportunities.

3.1 Builders

For each product group consumers were asked to make choices between different types of products. Using trade-off analysis (or conjoint analysis) respondents are forced to trade off different attributes of a product. For example they would not be able to get all the best possible attributes at the lowest possible price but must make choices concerning how they will spend their limited resources.

3.1.1 Simple Trade-Offs

Each respondent had to make a choice between 3 different types of engineered structural members described by one level from each of the six attributes. They could also select none of the choices given. Respondents had to do this twenty times with different levels used for the same attributes. Levels and attributes were chosen with input from the project steering committee and additional input from BC representatives in Japan. They are shown in Table 9 as well as the proportion of times a certain level within an attribute was selected. The statistical software used for conjoint analysis also completes statistical tests to ensure that differences are significant and not due to random chance.[5] Because there are over 2,000 choices made by over 125 builders even a small difference counts.

The way this table can be read follows:

- 49.6% of the time builders selected a price that was equivalent to solid wood,
- 33.7% of the time builders selected a price that was 20% greater than solid wood equivalent.

Because there are more than 2,000 selections the impact from the other attributes is minimized.

Table 9: Builders' Relative Selection of Levels within Attributes for ESP

Attribute Level	% of time selected	Attribute *Level*	% of time selected
Price		***Connections***	
same as solid wood alternative	49.6	traditional connections with bracing	29.8
20% more than solid wood alternative	33.7	new steel connectors	30.5
40% more than solid wood alternative	11.1	combination of traditional and steel	39.7
60% or more than solid wood	5.5		
Price stability		***Supplier***	
stable for 1 year	29.8	local retailer	19.8
stable for 6 month	26.2	local wholesaler	21.1
stable for 3 month	21.1	local pre-cutter	20.2
changes with solid wood	22.9	large national supplier	19.0
		many different sources	20.0
Strength		***Source of wood***	
meets minimum codes	21.2	European white wood	19.0
slightly stronger than code	22.6	Japanese wood	20.6
moderately stronger than code	26.9	Douglas fir	21.1
much stronger than code	29.6	Canadian Hemlock	19.4
		other offshore species	19.8

[5] Within each attribute there was a significant difference between levels tested using a Chi Square at ↦ = .01

Eighty-five builders answered the questions necessary for the trade off analysis. One of the most interesting results with the attributes was there were no significant differences between the various levels within two categories. There were no differences among levels for supplier (distributor) and source of wood. This means that for engineered structural products, builders' do NOT differentiate between products made from a wide variety of wood species. This facilitates substitution of existing products with new entrants and tends to provide no "brand" or "country of origin" advantage to current suppliers. It also suggests that price, technical specifications and service will determine which product builders choose to use.

The other attribute where there was no difference was the supplier in Japan or distribution source. This indicates that builders will purchase engineered structural products from a wide variety of sources, both local and national, large and small.

Price Almost half of the respondents select price levels that were the same as solid wood. Few are willing to select a price more than 20% greater than solid wood prices. This indicates that the preference for engineered structural products will not withstand substantial price differentials from solid wood.

Price Stability Over half of the builders select a price that would be stable for at least six months. Conversely less than a quarter selected a price which fluctuated as much as solid wood. This suggests that price stability is one of the key characteristics of engineered structural products. This is a characteristic that could be emulated by solid wood producers using long-term contracts. However it must be noted that this price stability no longer exists for many engineered structural products in Japan.

Strength Strength is one of the highest ranked attributes by builders. There are significant segments of builders preferring products that are stronger than existing code. However further analysis will determine whether builders will pay a price premium for increased strength.

Connections Connectors which use steel or steel combined with traditional connections is selected by over two thirds of the builders. Less than a third of the builders select traditional connectors (notches). This indicates a willingness to shift from more traditional connections to newer, more engineered connections, particularly if they incorporate some link to traditional notching..

3.1.2 Two Way Trade-Offs

Results also show how two different attributes interact with each other. People making purchasing decisions do not rely on a single product attribute in making their selection but on many attributes and how they interact with each other.

Only certain two-way trade offs are presented. Those interactions omitted are for the following reasons: 1) they provide little useful information, 2) there is little difference between different combinations or 3) statistical analysis indicated unreliable results. The results are summarized without presenting the tables or details of analysis for brevity.

Interaction of Price and Connections

- All types of connections are very price sensitive with a steep drop in popularity as price increases.
- Connections that use a combination of steel and traditional notching are least effected by a price premium. This indicates that builders want to try new connection and are somewhat

willing to pay a premium as long as the new connections incorporate some form of traditional notching.

- At a 20% price premium, the combination of steel and traditional is selected most frequently, followed by traditional, and lastly by new steel connectors, supporting the builders commitment to traditional connections.
- As the price premium increased to 40% then steel became the second choice overtaking traditional notching.
- There were so few builders that selected price premiums of 60% that no meaningful comparisons between connection types could be made.

Interaction of Strength and Source of Wood

- All species are considered to meet minimum building code.
- As strength properties increase then:
  - Other offshore species are selected least frequently,
  - Canadian Hemlock is selected less frequently, and
  - Douglas fir is selected more frequently

Interaction of Connections and Source of Wood

- Builders prefer new steel connectors if they are used with Douglas fir and to a lesser extent Hemlock (remember this is the least preferred connector).
- Builders prefer traditional connections if they are used with European white wood and Japanese wood.
- There is little species preference if the connections are a mix of traditional and steel.
- For all species a mix of traditional and steel connectors are preferred.

Other Interaction Observations[6]

- Price seems more important than price stability.
- Few builders are willing to pay any premium for Japanese or Canadian Hemlock.
- Premiums are most likely to be paid for Douglas fir and European white wood.
- At the highest premium (60%) European white wood is selected most frequently.

[6] These results do not have strong statistical support.

3.2 Pre-cutters

3.2.1 Simple Trade-Offs

One hundred and twenty five pre-cutters also made choices to provide information for this report. Results for the simple trade-offs are shown in Table 10.

Table 10: Pre-cutters' Relative Selection of Levels within Attributes for Engineered Structural Products

Attribute Level	% of time selected	Attribute *Level*	% of time selected
Price		***Connections***	
same as solid wood alternative	60.1	traditional connections with bracing	35.9
20% more than solid wood alternative	27.6	new steel connectors	27.0
40% more than solid wood alternative	8.6	combination of traditional and steel	37.1
60% or more than solid wood alternative	3.6		
Price stability		***Availability***	
stable for 1 year	28.2	all year	35.0
stable for 6 month	25.7	with 3 week delay	29.8
stable for 3 month	22.2	with 6 week delay	20.2
changes with solid wood	23.9	sporadically	15.0
Strength		***Source of wood***	
meets minimum codes	27.0	European white wood	19.7
slightly stronger than code	29.6	Japanese wood	20.2
moderately stronger than code	31.1	Douglas fir	23.6
much stronger than code	12.2	Canadian Hemlock	16.7
		other offshore species	19.8

Price Pre-cutters are even more price sensitive than builders suggesting very little willingness to pay any more than a 20% price premium for engineered structural products compared to solid wood alternatives. This suggests that the niche for higher priced glue laminated beams and other engineered wood products is finite and may have little room for additional growth. Thus new entrants would have to take market share from existing suppliers.

Price Stability Pre-cutters want price stability with small but significant increases in selection as price stability increased. Over three-quarters of respondents preferred stable prices for at least 3 months. However while statistically significant, the actual numbers of respondents in each group do not differ by large amounts.

Strength Respondents are interested in engineered structural products that are slightly or moderately stronger than code, few select much stronger than code. Given the importance of strength in the attribute ranking, over 60% of pre-cutters indicate interest in a stronger structural member.

Connections Similar to builders, the greatest preference is for a combination of traditional connections and steel, followed by traditional notching with bracing and lastly, steel connectors. However there are substantial numbers that selected each of the three methods of connecting members. It is clear that a combination of traditional with additional support from bracing or steel connectors is the most popular method of connecting engineered structural products.

Availability Pre-cutters prefer some security in availability with 85% preferring availability all year with no more than a 6-week delay from order to delivery. Consistent supply of engineered structural products is critical for pre-cutters. Almost two-thirds of respondents select a three-week delay or less indicating a need for either warehousing in Japan or very, very good logistics and transportation.

Source of Wood While there are statistically significant differences between the selections in source of wood, the actual numbers of pre-cutters selecting each source was relatively even. The least favoured wood for engineered structural products is Canadian Hemlock followed by European white wood. The most favoured source is Douglas fir.

3.1.2 Two Way Trade-Offs

Results also show how two different attributes interact with each other. People making purchasing decisions do not rely on a single product attribute in making their selection but on many attributes and how they interact with each other.

Only certain two-way trade offs are presented. Those interactions omitted are for the following reasons: 1) they provide little useful information, 2) there is little difference between different combinations or 3) statistical analysis indicated unreliable results. The results are summarized without presenting the tables or details of analysis for brevity.

Interaction of Price and Strength

- There is little indication that premiums would be paid for material that is slightly or moderately stronger than code.
- Engineered structural products that are much stronger than code could command a premium of 20-40%

Interaction between Price and Source of Wood

- If premiums are to be paid then they will be for Douglas fir and to lesser extent Japanese wood.
- Selection of Canadian Hemlock drops dramatically once any price premium is considered.
- Selection of other offshore species (including SPF) drops only slightly for a 20% premium.

Interaction between Availability and Source of Wood

- The selection of Canadian Hemlock declines the least as availability decreases.
- Douglas fir and Japanese wood are still selected frequently regardless of their availability.
- Preference for European white wood dropped precipitously if it is only available at certain times of the year.

Other Interaction Observations

- There is no indication that pre-cutters would pay a premium for better availability; although this may determine which product they select but without any premium.
- There is no connection between price stability and strength.

4 Market Simulation

The software enables analysis of market share potential and changes for different products with various levels of attributes. This allows calculation of potential market share given the production of engineered structural products. While not all possible combinations are calculated or shown the potential for engineered structural products will be explored by presenting several scenarios. For this analysis the results from builders and pre-cutters are presented separately since not all attributes are the same for these two groups of respondents.

4.1 Builders and Engineered Structural Products

Results from the first market share run for engineered structural products for the builders are shown in Table 11.

Table 11: ESP Market Share for Builders based on Species

European wood	Japanese wood	Douglas fir	Hemlock	other offshore	none of these
price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	
price changes with wood	price changes with wood	price changes with wood	price changes with wood	price changes with wood	
meets code	meets code	meets code	meets code	meets code	
combination connections	combination connections	combination connections	combination connections	combination connections	
many distributors	many distributors	many distributors	many distributors	many distributors	
11.8%	**13.5%**	**13.7%**	**12.2%**	**12.1%**	**36.7%**

There is a hard core of small builders (over a third) that would not use engineered structural products regardless of species. However if prices are the same as solid wood the number who would not use ESP shrinks to slightly over a quarter. All species capture about the same amount of increased market share.

- There is no single species favoured for engineered structural products with Hemlock and other offshore showing surprising strength given the dominance of the other three species groups.

If Hemlock were the only species to offer price stability for six months its market share would increase to 22.1%. Price stability for one year would add another 3% market share. The other species would not lose market share but the number of builders from the "none of these" selection would decline by 15%.

- By providing price stability the share of current suppliers of engineered structural products would not be cannibalized but the share of Hemlock or other Canadian ESP would increase.

If Hemlock is the only species to offer ESP with strength moderately greater than the building code required then its market share would increase to 24%. Once again this would not decrease the share of other species but would attract new users of ESP. If the strength were increased to only slightly stronger than code then the share for Hemlock would increase to slightly less than 20%.

- Increasing the strength, or promoting current superior strength properties, would not cannibalize the share of current suppliers of engineered structural products but would enhance the share of Hemlock or other Canadian ESP. However competing products could imitate this quality with little difficulty.

If Hemlock were to use new steel connectors, and is the only species to do so, then its market share would increase to almost 20% due to builders who currently do not use ESP switching to Hemlock ESP. This would also be true for other Canadian species.

Generally almost anything that can differentiate an ESP product from the current offerings (price stability, strength, and/or connectors) would increase sales and market share. However if the attribute were to be copied by other producers then any gain would be temporary. There may be an opportunity for a branding policy that would differentiate a single producer's product from competing products by associating some of the desired attributes with a single company. However the cost of developing and promoting such a product would have to be carefully weighed against the potential gains given competitor reaction.

If suppliers are local (retailers, wholesalers or pr-cutters) then more ESP would be used. About 10% of the market would switch to ESP from solid products if they were locally available. Relative share among species would not change. This indicates that engineered structural products have has significant room for growth among small builders once they can access local distribution systems.

4.2 Pre-cutters and Engineered Structural Products

Results from the first market share run for engineered structural products for the pre-cutters are shown in Table 12.

Over half the pre-cutters were not interested in engineered structural products regardless of species. It may be that pre-cutters felt that ESP would take away from their business activities. This number dropped dramatically from 59.4% to 37.2% if price is the same as the solid wood alternative. Market share by species is at this price is:

- European white wood 11.9%
- Japanese wood 13.2%
- Douglas fir 15.9%
- Hemlock 9.8%
- other offshore 12.1%
- none of these 37.2%

Table 12: ESP Market Share for Pre-cutters based on Species

European wood	Japanese wood	Douglas fir	Hemlock	other offshore	none of these
price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	price 20% ⇑ solid wood	
price changes with wood	price changes with wood	price changes with wood	price changes with wood	price changes with wood	
meets code	meets code	meets code	meets code	meets code	
combination connections	combination connections	combination connections	combination connections	combination connections	
available with 3 week delay	available with 3 week delay	available with 3 week delay	available with 3 week delay	available with 3 week delay	
7.7%	**8.5%**	**10.3%**	**6.3%**	**7.8%**	**59.4%**

- There were slight increases in the number who would not select engineered structural products if the connectors were either steel or traditional notching with cross bracing.
- Price stability had a negative impact on the number of pre-cutters willing to use ESP. Given recent decreases in prices for solid wood, pre-cutters were fearful of being caught in a stable price commitment while prices for solid wood alternatives were falling.
- Increasing strength had little impact on the number willing to use ESP or the market share for each species.
- Pre-cutters seemed dominated by price both for their decision whether to use ESP and for their selection of the species of ESP to use.

4.2 Further Market Share Analysis

Numerous scenarios are possible in market share analysis and not all possibilities are shown in this report. Should BC producers desire additional analysis please contact the authors.

5 Results

5.1 Summary of Key Results

- Over the next 3 years small house builders expect:
  - traditional post and beam construction to decline dramatically (49%), 2 by 4 to increase substantially (28%), hybrid houses to increase dramatically (154%), steel and concrete to increase slightly (<6%) and prefabricated houses to decline slightly.
- Over the next 3 years pre-cutters expect:
  - traditional post and beam construction to decline slightly (2%), 2 by 4 to increase slightly (1%), hybrid houses to increase (3%) and steel, concrete and prefabricated houses to decrease slightly (<2%).
- Builders and pre-cutters prefer to build post and beam houses in the traditional manner even if paneling is required.
- Both builders and pre-cutters are very aware of the growing concern with formaldehyde emissions. Slightly less than half of each group is willing to pay a small premium for a panel with emission less than current standards allowed.
- Builders prefer solid wood for structural use followed by engineered wood products, steel and lastly concrete.
- Both groups rank strength, durability and price stability as the most important attributes of engineered structural systems.
  - Builders consider connections as more important than pre-cutters while pre-cutter rank security of supply slightly higher than builders.
  - Both groups consider source of material (distributor) and country of origin as unimportant.

	Builders' Rank	Pre-cutters' Rank
strength	1	1
durability	2	3
price stability	3	2
connections	4	7
security of supply	5	4
species	6	5
supply reliability	7	
treatability	8	8
source of material	9	10
country of manufacture	10	9

- Builders expect ESP to capture 85% of the market for hari (upper level beams) (pre-cutters 95%).
  - Builders and pre-cutters expect ESP to capture over 50% of the market for posts, beams and upper level beams.
  - Greatest growth (in %) for hari, obiki and neda for both groups.
  - Both groups expect increased use of ESP in all structural applications in traditional house.
  - Builders expect to use a greater proportion of solid wood for taruki, neda (joist), obiki (joist beams), foundations, and mabashira (studs) despite the growth in using ESP.
  - Pre-cutters expect higher use of ESP than builders.
- Strength is the highest-ranking attribute for both groups.
  - Preference by both builders and pre-cutters is for slight or moderate strength increases relative to current codes.
- Few builders or pre-cutters are willing to pay premiums for increased strength.
- As strength requirements increase, builders consider Douglas fir more frequently and Hemlock less frequently.
- While price stability is a highly ranked attribute, the trade-off analysis indicates that price is more important than price stability.
- Respondents indicate a preference for prices that are stable for 3 months or more.
- Builders rank connections higher than pre-cutters do.
  - Builders and pre-cutters prefer traditional connections that also use steel followed by steel and traditional with almost equal preferences
- The country of origin, and the source of materials (distributor) are relatively unimportant to both groups.
- Any preference pre-cutters had for Canadian Hemlock drops precipitously once prices increase.
- Douglas fir, followed by Japanese wood, are the species of choice for pre-cutters, while builders had no specific preference for any species.
- Both groups are very price sensitive with no indication of willingness to pay premiums for any attribute.
  - Species could substitute for each other.
  - Connections are the least price sensitive.
  - A small premium is available for health related attributes.
  - If premiums are paid by builders, it would be for Douglas fir.

5.2 Opportunities

- Preference for solid wood indicates an opportunity to provide "engineered solid structural members" for traditional housing in Japan.
  - These could be dry, MSR members for use in taruki, neda (joist), obiki (joist beams), foundations, and mabashira (studs).
  - These products should be available with a maximum of 3 weeks lead time.
  - They should be priced between laminated products and solid green products.
  - They should ignore species make-up and focus on strength and stability characteristics.
- Solid wood members should incorporate information and promotion on low emissions for "healthy houses" relative to ESP and non-wood alternatives.
- Combining the information from ESP with that from Building Systems (see Report F) suggests incorporating ESP in newly designed row houses or hybrid houses.
- With price a key issue, relative cost of production in BC needs to be compared with current and future suppliers of ESP in this market (e.g. Austria, US, Sweden, New Zealand and Japan).
  - To succeed BC producers must be low cost producers in this higher cost market niche.

Appendix D: Engineered Structural Products Survey Questions for Builders and Pre-Cutters

General Questions for Builders

1. Please indicate how many houses you build in a year?

   1-5 _____
   6-10 _____
   10-20 _____
   21 and over _____

2. Please indicate what type of houses you built in 1997.

Type of House	Number	% of total
traditional (Post and beam)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

3. Please indicate what type of houses you expect to build three years from now.

Type of House	Number	% of total
traditional (Post and beam)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

4. Which type of construction method would you prefer?

	Low preference						High preference
traditional	1	2	3	4	5	6	7
traditional (panel frame)	1	2	3	4	5	6	7
2X4	1	2	3	4	5	6	7
2X4 (panel method)	1	2	3	4	5	6	7
pre-fabricated	1	2	3	4	5	6	7

5. Are you aware of the growing concern over formaldehyde emissions in Japanese homes?

   YES _____ NO _____

6. Would you be interested in a panel with 1/50th of the formaldehyde emission levels of government standards?

   YES _____ NO _____

6. Would you be prepared to pay a small premium for such a panel?

   YES _____ NO _____

Questions for Builders on Engineered Structural Products

9. Please rank the five most important of the following product attributes with number 1 being the most important.

_____ Price stability
_____ Strength
_____ Type of Connection
_____ Source of Material Supply
_____ Species
_____ Country of manufacture
_____ Durability
_____ Reliability of supplying firm
_____ Security of supply over several years
_____ ease of treatability of building material

10. If you built post and beam please answer the following question. Please indicate which of the following types of structural members you have used, consider using or expect to use engineered structural products.

	Have used	Consider Using	Expect to within 3 years
foundation itself	_____	_____	_____
hari (upper level beams))	_____	_____	_____
keta (beam)	_____	_____	_____
obiki (joist beam)	_____	_____	_____
neda (joist)	_____	_____	_____
kanbashira (posts)	_____	_____	_____
toshibashira	_____	_____	_____
taruki	_____	_____	_____
mabashira (stud)	_____	_____	_____

General Questions for Pre-cutters

1. Please indicate how many houses you supply material for in a month?

   1-5 _____
   6-10 _____
   10-20 _____
   21 and over _____

2. Please indicate what type of houses you supplied material for in 1997.

Type of House	Number	% of total
Post and beam (traditional)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

3. Please indicate what type of houses you expect to supply material for three years from now.

Type of House	Number	% of total
Post and beam (traditional)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

4. Which type of construction method would you prefer to supply material for?

	Low preference						High preference
traditional	1	2	3	4	5	6	7
traditional (panel frame)	1	2	3	4	5	6	7
2X4	1	2	3	4	5	6	7
2X4 (panel)	1	2	3	4	5	6	7
pre-fabricated	1	2	3	4	5	6	7

5. Are you aware of the growing concern over formaldehyde emissions in Japanese homes?

   YES _____ NO _____

6. Would you be interested in a panel with 1/50th of the formaldehyde emission levels of government standards?

   YES _____ NO _____

7 Would you be prepared to pay a small premium for such a panel?

   YES _____ NO _____

8 Do you offer treating services?

   yes_____ no_____

Questions for Pre-cutters on Engineered Structural Products

12. Please rank the five most important of the following product attributes with number 1 being the most important.

_____ Price stability
_____ Strength
_____ Type of Connection
_____ Company of manufacturer
_____ Species
_____ Country of manufacture
_____ Durability
_____ Distributor
_____ Security of supply over several years
_____ ease of treatability of building materials

13. Please indicate which of the following types of structural members you have used, considered using or expect to use engineered structural products.

	Have used	Considered	Expect to within 3 years
foundation itself	_____	_____	_____
hari (upper level beams))	_____	_____	_____
keta (beam)	_____	_____	_____
obiki (joist beam)	_____	_____	_____
neda (joist)	_____	_____	_____
kanbashira (posts)	_____	_____	_____
toshibashira	_____	_____	_____
taruki	_____	_____	_____
mabashira (stud)	_____	_____	_____